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I also certify that by virtue of an assignment registered under the Patents Act 1977, the application is now proceeding in the name as substituted.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Signed *Andrew Gersey*
Dated 3 November 1999





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GB9823083.2

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of

DEVRO PLC
Modiesburn
Chryston
GLASGOW
G69 0JE
United Kingdom

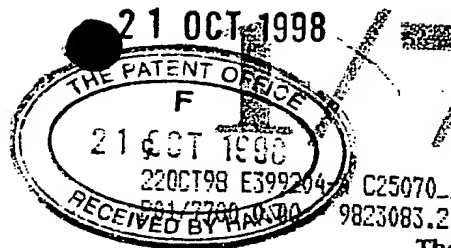
Incorporated in the United Kingdom

[ADP No. 07054794001]

FRAUNHOFER-GESELLSCHAFT ZUR FÖRDERUNG DER ANGEWANDTEN
FORSCHUNG E.V.
Leonrodstrasse 54
80636 Munich
Federal Republic of Germany

[ADP No. 07417058002]





The Patent Office

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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference

DCM/ED/P08433GB

2. Patent application number

(The Patent Office will fill in this part)

9823083.2

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Devro plc
Moodiesburn
Chr
Glasgow G69 0JE

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

Scotland, United Kingdom

4. Title of the invention

Extrusion Apparatus

5. Name of your agent (if you have one)

Cruikshank & Fairweather
19 Royal Exchange Square
Glasgow G1 3AE

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Patents ADP number (if you know it)

547002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.
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Continuation sheets of this form

Description	5
Claim(s)	1
Abstract	-
Drawing(s)	2

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

Request for preliminary examination and search (*Patents Form 9/77*)

Request for substantive examination (*Patents Form 10/77*)

Any other documents
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Cruikshank & Fairweather Date

Cruikshank & Fairweather 20 October 1998

12. Name and daytime telephone number of person to contact in the United Kingdom

D C MacDougall
0141 221 5767

Warning

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Notes

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EXTRUSION APPARATUS

This invention relates to apparatus for use in extrusion operations, and in particular to apparatus for use in extrusion of a blown film into a precipitation medium. The invention also relates to a method of extruding a blown film.

According to the present invention there is provided apparatus for use in extrusion of a blown film into a precipitation medium, the apparatus comprising a tubular member for containing precipitation medium and for receiving an extruded blown tube.

According to another aspect of the present invention there is provided a method of extruding blown film, the method comprising:

- extruding material through a die to form a tube;
- maintaining the tube interior at a positive pressure;
- and
- passing the tube through a precipitation medium contained within a tubular member.

The aspects of the invention are useful in extrusion operations where a material, such as a cellulose\N-Methyl Morpholine N-Oxide (NMMO) melt solution, is extruded into a precipitation medium, which in the case of a cellulose/NMMO solution is water or aqueous NMMO solution,

where the melt solution precipitates, typically to a solid semi-gel state.

The tubular member may serve a number of useful functions: the member may be utilised to guide the extruded tube through the precipitation medium; and the member protects the extruded tube from disturbances in the precipitation medium. As a result, it has been found that the presence of such a tubular member improves the uniformity of the tube wall thickness.

Preferably, the extruded material is a mixture of cellulose in tertiary amine-oxide, such as N-Methyl Morpholine N-Oxide (NMMO) as discussed above.

Preferably also, the inner diameter of the tubular member is between 1.05 and 1.5 times the outer diameter of the extruded tube.

The precipitation medium will typically be provided as a bath of liquid, with the precipitation liquid present both inside and surrounding the tube, and it is preferred that the tubular member is at least partially immersed in the liquid.

Preferably also, an air gap is provided between the extrusion die and the bath of precipitation liquid, and by providing a positive pressure in the air gap within the extruded tube a blowing up or inflation of the tube results. Conveniently, this is achieved by introducing pressurised air into the air gap within the tube.

Preferably also, the extruded tube moves downwardly through the tubular member. Most preferably, the tubular

member is vertically oriented.

Preferably also, the tubular member is transparent, permitting the extruded tube to be viewed as it passes through the member.

The tubular member may have a solid wall, or may have a perforated or discontinuous wall.

Preferably also, the precipitation medium flows, preferably axially, between the extruded tube and the tubular member.

Preferably also, following precipitation, the extruded tube is flattened by pick-up members, typically pick-up rollers, and the tubular member is profiled to guide the extruded tube to the pick-up members.

These and other aspects of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic representation of extrusion apparatus incorporating an embodiment of the present invention; and

Figure 2 is an enlarged view of an area of Figure 1, and showing a tube-guiding pipe.

Reference is first made to Figure 1 of the drawings, which is a schematic representation of extrusion apparatus for use in forming blown cellulose film casings.

In the illustrated example, a mixture of cellulose and N-Methyl Morpholine-N-oxide (NMMO) is heated to 100°C to form a viscous elastic melt which is introduced into a screw extruder 12. Within the extruder 12, the heated

mixture 10 is transported, through a filter screen (not shown), to a gear metering pump section 14 which feeds the material to an annular extrusion die 16. The die 16 is oriented to direct the extrudate, in tubular form 22, downwards into a precipitation water bath 18, at a temperature between 10 and 20 °C.

An air gap 20 is provided between the die 16 and the upper surface of the bath 18, and pressurised air in the range 0.2 to 2.0 mbar is supplied into the air gap 20 through the die 16 to blow up the extruded tube 22.

The outer skin of the tube 22 is precipitated by the water surrounding the tube in the bath 18; the inner skin of the tube 22 is precipitated by water which fills the tube interior, and which is supplied into the tube 22 through the die 16, water and NMMO being drawn from the tube 22 to maintain the NMMO concentration at an appropriate level.

Within the bath 18, the extruded tube 22 is surrounded by a tubular member in a form of a pipe 24 (see also Figure 2 of the drawings), which guides the tube 22 to a pair of nip rolls 26. It will be noted from the figures that the lower end of the pipe 24 is tapered to guide the tube 22 between the rolls 26. During the extrusion operation, the water in the bath 18 is free to circulate vertically between the pipe 24 and the tube 22, to ensure precipitation of the tube outer skin. The upper end of the pipe 24 may be above or below the surface of the precipitation liquid within the bath 18.

The flattened tube 22 passes from the rolls 26 around further rolls in the bath and then passes from the bath and through various other processing stages, including washing and drying, and which will not be described in any detail herein.

It has been found that the use of the hollow pipe 24 as described above provides improved size stability of cellulose blown tubes, that is reduced film thickness variation, when compared to existing processes for producing cellulose film, such as described in International Patent Application No. WO95\35340. Although not wishing to be bound by theory, it is believed that the pipe 24 acts as an outer guide for the extruded tube 22, provides a protective barrier for the extruded tube 22 against disturbances in the precipitation bath 18, and also serves to guide the extruded tube 22 into the pick-up rolls 26.

It will be apparent to those of skill in the art that the above described embodiment is merely exemplary of the present invention, and that various modifications and improvements may be made therein without departing from the scope of the invention.

CLAIMS

1. Apparatus for use in extrusion of a blown film into a precipitation medium, the apparatus comprising a tubular member for containing precipitation medium and for receiving an extruded blown tube.

2. A method of extruding blown film, the method comprising:

extruding material through a die to form a tube;

maintaining the tube interior at a positive pressure;

and

passing the tube through a precipitation medium contained within a tubular member.

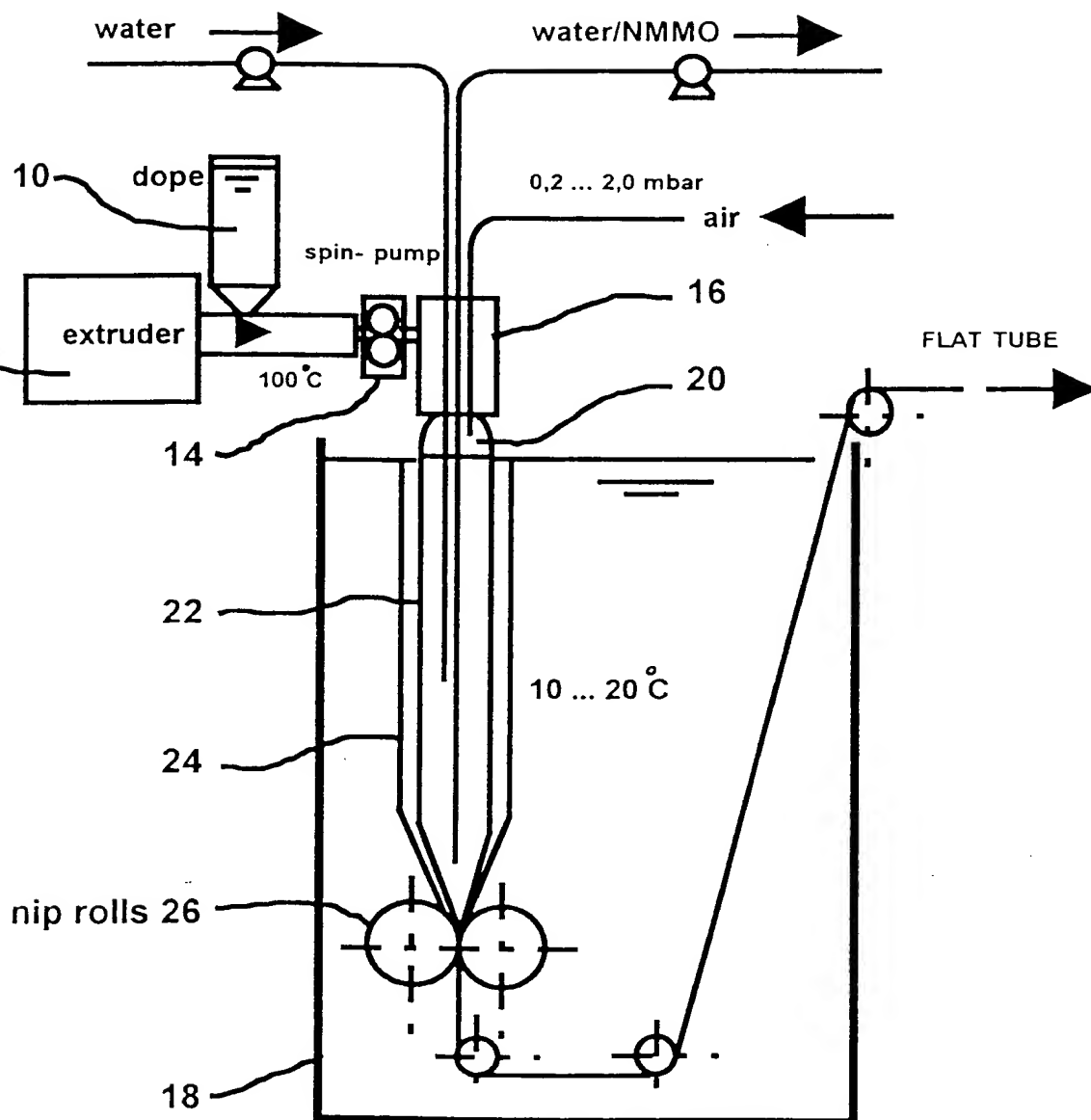


FIGURE 1 :



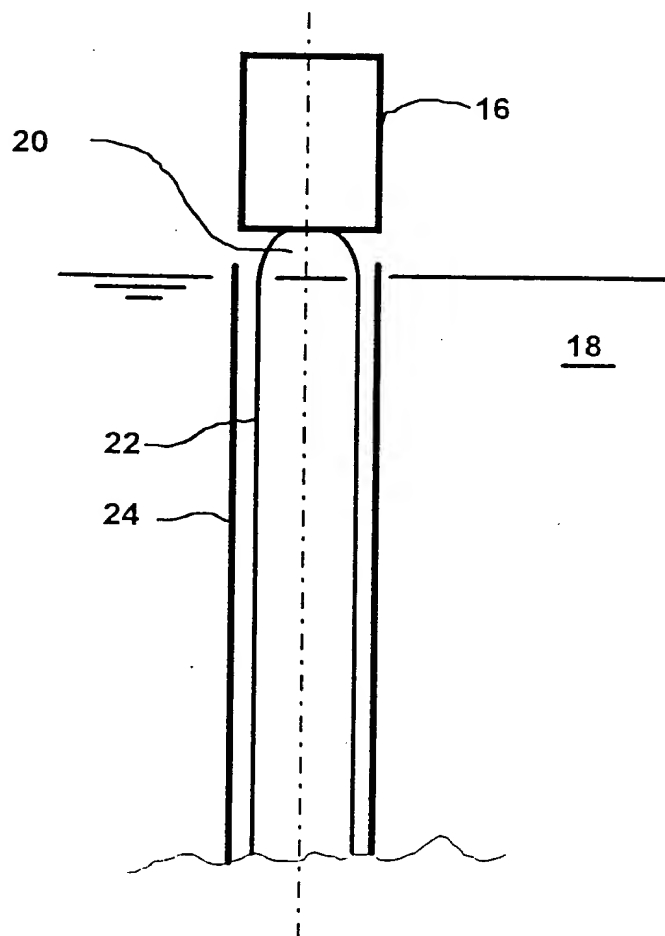


FIGURE 2 :

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